

In the Claims:

Please amend claims 1-5, 8-29 and 31, and add new claims 37-38. The status of the claims is as follows:

1. (Currently Amended) ~~An apparatus~~ A buck-boost converter for converting a plurality of dc input voltages from a plurality of voltage sources to at least one dc output voltage, the ~~apparatus~~ converter comprising:

a plurality of voltage inputs;

a respective current-conducting-bidirectional-voltage-blocking switch in an electrical path from each of said voltage inputs;

a magnetically inductive device in an electrical path from each of said current-conducting-bidirectional-voltage-blocking switches; and

a voltage output bucked or boosted relative to one of said voltage inputs in an electrical path from said magnetically inductive device.

2. (Currently Amended) ~~The apparatus~~ converter recited in claim 1, wherein

said voltage output comprises one of a plurality of voltage outputs.

3. (Currently Amended) ~~The apparatus~~ converter recited in claim 1, wherein

said magnetically inductive device comprises an inductor.

4. (Currently Amended) ~~The apparatus~~ converter recited in claim 1, wherein

said magnetically inductive device comprises a transformer.

5. (Currently Amended) The ~~apparatus~~ converter recited in claim 4, wherein  
said voltage output is reversed in polarity relative to one of said voltage inputs.

6-7. (Canceled)

8. (Currently Amended) The ~~apparatus~~ converter recited in claim 1 in an electrical path with a secondary converter (32), the apparatus having said voltage output fed back to one of said plurality of said voltage inputs through said secondary converter.

9. (Currently Amended) The ~~apparatus~~ converter recited in claim 1 wherein  
each of said current-conducting-bidirectional-voltage-blocking switches is switched on substantially simultaneously with a switch signal;  
each of said current-conducting-bidirectional-voltage-blocking switches has a different duty cycle;  
a voltage index  $i$  is assigned to each voltage source connected to a voltage input of plurality of said voltage inputs such that  $V_1 > V_2 > \dots V_n$ ; and  
each of said current-conducting-bidirectional-voltage-blocking switches has an effective duty cycle  $D_{eff(i)}$  of

$$D_{eff(i)} = \begin{cases} 0, & D_i < \sum_{j=1}^{i-1} D_{eff(j)} \\ D_i - \sum_{j=1}^{i-1} D_{eff(j)}, & D_i \geq \sum_{j=1}^{i-1} D_{eff(j)} \end{cases}$$

such that a voltage at the voltage output  $V_o$  is

$$V_o = \frac{\sum_i D_{eff(i)} V_i}{1 - \max_i (D_i)}.$$

10. (Currently Amended) The ~~apparatus~~ converter recited in claim 9, further comprising:

an input control circuitry in an electrical path to each of said respective current-conducting-bidirectional-voltage-blocking switches for controlling switching of said current-conducting-bidirectional-voltage-blocking switches.

11. (Currently Amended) The ~~apparatus~~ converter of claim 1 wherein a current through said magnetically inductive device, said magnetically inductive device having an inductance  $L$ , is greater than zero in steady state operation;

each of said current-conducting-bidirectional-voltage-blocking switches is switched on and off with a binary switching signal having a value of 1 or 0;

said voltage output is connected to a resistive load  $R$ ;

only one of each of said current-conducting-bidirectional-voltage-blocking switches is switched on in any given period of time  $T$ , such that

a current in the magnetically inductive device  $i_p$  is

$$i_p = \sum_j |\Delta i_j| = \frac{T}{L} \sum_j D_{eff(j)} V_j,$$

and

a voltage at the voltage output  $V_{out}$  is

$$V_{out} = i_p \sqrt{\frac{RL}{2T}}.$$

12. (Currently Amended) The ~~apparatus~~ converter recited in claim 11, further comprising:

input control circuitry in an electrical path to each of said respective current-conducting-bidirectional-voltage-blocking switches for controlling switching of said current-conducting-bidirectional-voltage-blocking switches.

13. (Currently Amended) ~~The apparatus~~ converter recited in claim 1, wherein

said current-conducting-bidirectional-voltage-blocking switch comprises a forward-conducting-bidirectional-blocking switch.

14. (Currently Amended) ~~The method~~ converter recited in claim 1, wherein said current-conducting-bidirectional-voltage-blocking switch comprises a bidirectional-conducting-bidirectional-blocking switch.

15. (Currently Amended) ~~An apparatus~~ A buck-boost converter for providing dc power from more than one source to at least one load, ~~the apparatus~~ comprising:

a magnetically inductive device;

a plurality of inputs for respective sources in parallel through respective current-conducting-bidirectional-voltage-blocking switches to said magnetically inductive device; and

at least one output bucked or boosted relative to one of said inputs for at least one load in parallel with a capacitor in series with a diode to said magnetically inductive device.

16. (Currently Amended) ~~The apparatus~~ converter recited in claim 15, further comprising:

input control circuitry in electrical paths to said respective current-conducting-bidirectional-voltage-blocking switches for switching said respective current-conducting-bidirectional-voltage-blocking switches to open and close said electrical paths from said inputs to said magnetically inductive device.

17. (Currently Amended) The ~~apparatus~~ converter recited in claim 16 wherein said input control circuitry closes at most only one of said respective current-conducting-bidirectional-voltage-blocking switches at a given time.

18. (Currently Amended) The ~~apparatus~~ converter recited in claim 16 wherein said input control circuitry closes up to all of said respective current-conducting-bidirectional-voltage-blocking switches at a given time.

19. (Currently Amended) The ~~apparatus~~ converter recited in claim 15 wherein  
said magnetically inductive device comprises a transformer, said transformer comprising

at least one primary winding and

at least one secondary winding;

the apparatus further comprises

at least one bidirectional output

in an electrical path in parallel through an additional current-conducting-bidirectional-voltage-blocking switch from  
said at least one secondary winding of said magnetically inductive device, and

in an electrical path to an input of said plurality of inputs; and  
bidirectional control circuitry for switching said additional current-conducting-bidirectional-voltage-blocking switch.

20. (Currently Amended) The ~~apparatus~~ converter recited in claim 19 wherein  
said load that may serve as a source comprises a rechargeable battery.

21. (Currently Amended) The ~~apparatus~~ converter recited in claim 15  
wherein

said magnetically inductive device comprises a transformer including at least one primary winding and at least one secondary winding.

22. (Currently Amended) The ~~apparatus~~ converter recited in claim 15  
wherein

said transformer includes a plurality of secondary windings and  
said at least one output includes respective outputs in electrical paths to each of said plurality of secondary windings.

23. (Currently Amended) The ~~apparatus~~ converter recited in claim 15  
wherein

at least one output includes  
at least one output in an electrical path to a primary winding of said at  
least one primary winding and  
at least one output in an electrical path to said at least one secondary  
winding.

24. (Currently Amended) The ~~apparatus~~ converter recited in claim 15,  
wherein

said current-conducting-bidirectional-voltage-blocking switch comprises a forward-conducting-bidirectional-blocking switch.

25. (Currently Amended) The ~~method~~ converter recited in claim 15,  
wherein

said current-conducting-bidirectional-voltage-blocking switch comprises a bidirectional-conducting-bidirectional-blocking switch.

26. (Currently Amended) A buck-boost system for supplying power to a load from a plurality of sources, the system comprising:

- a plurality of sources;
- a respective voltage input in an electrical path from each of said plurality of sources;
- a respective current-conducting-bidirectional-voltage-blocking switch in an electrical path from each of said voltage inputs;
- input control circuitry in an electrical path to each of said respective current-conducting-bidirectional-voltage-blocking switches for controlling switching of said current-conducting-bidirectional-voltage-blocking switches;
- a magnetically inductive device in an electrical path from each of said current-conducting-bidirectional-voltage-blocking switches; and
- a voltage output bucked or boosted relative to one of said voltage inputs in an electrical path from said magnetically inductive device.

27. (Currently Amended) The ~~apparatus~~ system recited in claim 26, wherein said current-conducting-bidirectional-voltage-blocking switch comprises a forward-conducting-bidirectional-blocking switch.

28. (Currently Amended) The ~~method~~ system recited in claim 26, wherein said current-conducting-bidirectional-voltage-blocking switch comprises a bidirectional-conducting-bidirectional-blocking switch.

29. (Currently Amended) A ~~system~~ buck-boost for substantially equalizing the charges of a plurality of rechargeable voltage sources, the system comprising:

- a plurality of rechargeable voltage sources arranged serially in an electrical path;

respective voltage inputs in respective electrical paths to all excepting at least one of said rechargeable voltage sources;

respective current-conducting-bidirectional-voltage-blocking switches in respective electrical paths to said all excepting at least one of said plurality of rechargeable voltage sources;

a magnetically inductive device in an electrical path with said current-conducting-bidirectional-voltage blocking switches;

an output comprising a ~~voltage input~~ output and a ~~current input~~ output, said voltage output being bucked or boosted relative to one of said voltage inputs and in parallel with a capacitor in series with a diode to said magnetically inductive device;

wherein said current output is fed back to a rechargeable voltage source that is not comprised in said all excepting at least one of said rechargeable voltage sources.

30. (Original) The system recited in claim 29 further comprising:  
a load in an electrical path to said output.

31. (Currently Amended) A method for selectively connecting a plurality of voltage input sources that are in an electrical connection to a magnetically inductive device, the magnetically inductive device being in an electrical path to at least one load, the method comprising:

accepting a signal to select one or more of said plurality of voltage input sources; and

based upon said signal, selectively blocking up to all of said plurality of voltage input sources from said magnetically inductive device.

32. (Original) The method recited in claim 31, further comprising:  
sensing a current in said magnetically inductive device.



33. (Original) The method recited in claim 32, wherein said sensing is performed with only a single sensor.

34. (Original) The method recited in claim 31, further comprising: decoding of said signal to obtain a switching state.

35. (Original) The method recited in claim 34, further comprising: determining a current coming into each of said voltage input sources.

36. (Original) The method recited in claim 35, wherein said determining comprises decomposing said current in said magnetically inductive device based upon said switching state.

37. (New) An apparatus for converting a plurality of dc input voltages from a plurality of voltage sources to at least one dc output voltage, the apparatus comprising:  
a plurality of voltage inputs;  
a respective current-conducting-bidirectional-voltage-blocking switch in an electrical path from each of said voltage inputs;  
a magnetically inductive device in a common electrical path shared by each of said current-conducting-bidirectional-voltage-blocking switches; and  
a voltage output in an electrical path from said magnetically inductive device.

38. (New) The apparatus as defined in claim 37, wherein said inductive device is downstream of said current-conducting-bidirectional-voltage-blocking switches.